

IN THE DRAWINGS:

Pursuant to the enclosed separate Letter to the Examiner Requesting Approval of Drawing Changes, amendment to FIG. 5 is respectfully requested.

REMARKS

INTRODUCTION:

In accordance with the foregoing, the specification and FIG. 5 have been amended in order to replace the term "Comparative Example 2" with "Example 6" in order to more accurately reflect the scope of the invention as set forth in the specification and the claims as originally presented so as to clarify the public record. Claim 1 has been amended without narrowing the scope of the claim as compared to claim 1 as initially filed.

No new matter is being presented, and approval and entry are respectfully requested.

Claims 1-17 and 29-39 are pending and claims 1-17, 38, and 39 are under consideration. Reconsideration is requested.

On page 2 of the Office Action, the Examiner requires cancellation of withdrawn claims 29-37 or other appropriate action. However, it is respectfully submitted that withdrawn claims 29-37 have been amended to depend from elected linking claim 1. As noted in MPEP 809.04, "[w]here the requirement for restriction in an application is predicated upon the nonallowability of generic or other type of linking claims, applicant is entitled to retain in the case claims to the nonelected invention or inventions." As such, it is respectfully requested that the withdrawn claims 29-37 be allowed to remain in the instant application as per MPEP 809 since the applicants have taken the other appropriate action required in the Office Action.

ENTRY OF AMENDMENT UNDER 37 C.F.R. §1.116:

Applicant(s) request(s) entry of this Rule 116 Response because the amendments should not entail any further search by the Examiner since no new features are being added or no new issues are being raised; and the amendments do not significantly alter the scope of the claims and place the application at least into a better form for purposes of appeal. No new features or new issues are being raised.

The Manual of Patent Examining Procedures sets forth in Section 714.12 that "any amendment that would place the case either in condition for allowance or in better form for appeal may be entered." Moreover, Section 714.13 sets forth that "the Proposed Amendment should be given sufficient consideration to determine whether the claims are in condition for allowance and/or whether the issues on appeal are simplified." The Manual of Patent Examining Procedures further articulates that the reason for any non-entry should be explained expressly in the Advisory Action.

REJECTION UNDER 35 U.S.C. §132:

In the Office Action at pages 2-3, the Examiner objects to the amendment to claim 2 under 35 U.S.C. §132 for introducing new matter into the specification. The objection is traversed and reconsideration is respectfully requested.

By way of review, claim 2 was amended to recite that "the average size of the pores is greater than substantially 5 μm and is ~~up to~~ less than 10 μm ." As originally presented, claims 2 and 3 of the instant application respectively recited pore sizes of "up to 10 μm " and "up to 5 μm ." As such, the original claims, as presented, included coverage for pore sizes between 5 and 10 μm by reciting coverage for sizes below 5 μm (i.e., < 5 μm) and below 10 μm (<10 μm). Moreover, claim 1, as originally presented, recited pores of sizes below 20 μm (<10 μm) such that, as filed, the original claims recited coverage for pore sizes in excess of 10 μm . Since the claims are part of the specification as filed, it is respectfully submitted that claim 2 recites a range clearly within the scope of claims 1-3 as originally presented.

As a general matter, 35 U.S.C. §132 prevents the introduction of information not existing in the application as filed. However, where the disclosure exists in the specification as filed, the introduced information is not considered new matter. MPEP 608.04. Further, where the introduced information exists in the claims, the disclosure extends to the claimed description such that the introduced information is not considered new matter. MPEP 608.01(I). Moreover, in the context of ranges, where a range is disclosed, each number within the range is necessarily (and inherently) disclosed such that the recitation of a number or set of numbers within the originally disclosed range is necessarily included in the original disclosure.

By way of example, MPEP 2163.05(III) discusses the situation in In re Wertheim, 191 USPQ 90 (CCPA 1976). As described in MPEP 2163.05, the applicant originally disclosed an original range of 25%- 60%. This original range was not found to support a range or "at least 35" since this range extended beyond the original range. In contrast, the original range of 25%- 60% did support a range between 35% and 60% for the purposes of 35 U.S.C. §112. As such, in order for there to be support for an amended range within the claim, the bounds of the amended range needs to be at least mathematically between the more broadly disclosed bounded range since all amounts within the broad bounded range are necessarily disclosed as would be understood by one of ordinary skill in the art.

Therefore, since the range recited by claim 2 is within the ranges defined by claims 1-3, it is respectfully submitted that claim 2 is compliant with the requirements of 35 U.S.C. §132, and it is requested that the Examiner reconsider and withdraw the objection.

REJECTION UNDER 35 U.S.C. §112:**A. Rejection of claims 1-17, 38, and 39**

In the Office Action at pages 3-4, the Examiner rejects claims 1-17, 38, and 39 under 35 U.S.C. §112, first paragraph, as not being enabled since the claimed subject matter is not commensurate with the scope of the enabling disclosure. This rejection is respectfully traversed and reconsideration is requested.

In rejecting the claims, the Examiner relies upon the disclosures of Tables 1 and 2 of the instant application. Specifically, the Examiner notes that Tables 1 and 2 show, for a battery using a particle size of 15µm in Comparative Example 2, the battery exhibited a 45% reduction in capacity after 50 cycles. The Examiner further states that the battery of Example 5 has a discharge capacity which is twice that of the Comparative Example 2 battery. From this disclosure, the Examiner asserts that the specification specifically warns away from using a particle size of 15µm or greater.

As a point of clarification, even assuming arguendo Tables 1 and 2 show that a particle size of 15µm is not as advantageous as smaller particle sizes, the specification does not clearly warn against using particle sizes of 15µm. Specifically, paragraph 0022 discloses that the present invention include embodiments with pores of up to 20 µm. Further, paragraph 0026 discloses an embodiment in which particle sizes are up to 20 µm. Similar passages exist in describing embodiments of the invention both in paragraph 0041 as well as in claims 1, 5, 19, 29, and 33 as originally presented. As such, it is respectfully submitted that the specification does not clearly warn against using particle sizes of 15 µm.

Moreover, even if the particle size of 15 µm is not as advantageous, there is no suggestion that the less advantageous features set forth in Tables 1 and 2 are so far below a minimum requirement that they are not workable with the present invention. Therefore, it is respectfully submitted that the specification of the instant application does not clearly warn against using particle sizes of 15 µm since the original specification clearly describes the use of particle sizes of up to 20 µm, and reconsideration and withdrawal of the rejection is respectfully requested.

However, in order to clarify the specification without narrowing the scope of the invention, the specification has been amended to replace the references to Comparative Example 2 as Example 6. No new matter has been added.

B. Rejection of claim 2

On page 4 of the Office Action, the Examiner rejects claim 2 under 35 U.S.C. §112, first

paragraph, as not being supported by the written description. This rejection is respectfully traversed and reconsideration is requested.

The Examiner asserts that there is insufficient evidence from the specification as filed to support "the average size of the pores is greater than substantially 5 μm and is less than 10 μm " as recited in claim 2 since the specification merely describes pores of less than 20 μm , less than 10 μm , and less than 5 μm . However, as noted in MPEP 2163.05 in the context of ranges, where a bounded range is disclosed, each number within the range is necessarily disclosed such that the recitation of a number or set of numbers within the originally disclosed range is necessarily included in the original disclosure. As such, in order for there to be support for an amended range within the claim, the bounds of the amended range needs to be at least mathematically between the more broadly disclosed bounded range since all amounts within the broad bounded range are necessarily disclosed as would be understood by one of ordinary skill in the art. Since the bounds of the range disclosed in claim 2 are within the bounds originally presented in at least claims 1-3 as filed and paragraphs 0022, 0041, it is respectfully submitted that claim 2 remains compliant with 35 USC 112 and that the Examiner reconsider and withdraw the rejection.

REJECTION UNDER 35 U.S.C. §103:

A. Rejection of claims 1-4, 8-17, 38, and 39 in view of Chu and Japanese patent publication no. 47-28431

In the Office Action at pages 5-10, the Examiner rejects claims 1-4, 8-17, 38, and 39 under 35 U.S.C. §103 in view of Chu (U.S. Patent No. 5,523,179) and Japanese patent publication no. 47-28431 (hereinafter referred to as "JP '431"). The rejection is respectfully traversed and reconsideration is requested.

Among other features, the Examiner asserts that Chu teaches a lithium-sulfur battery using an active sulfur in a positive electrode and a lithium metal in the anode. However, the Examiner acknowledges on page 8 of the Office Action that Chu does not teach the positive electrode having pores as recited in claims 1-3. In order to cure this deficiency, the Examiner relies upon JP '431 as disclosing a cathode including sulfur and having pores in a range of 10-1000 μm . As a motivation to combine the references, the Examiner relies upon the Abstract of JP '431 as teaching that, since sulfur is an electric insulator, a porous separator with pore diameters of 10-1000 μm is essential to increase the conductivity.

On pages 11-12 of the Office Action, the Examiner clarifies that this evidence of motivation is sufficient to support a prima facie obviousness rejection since the combined teachings of Chu and JP '431 suggest the combination. While the Examiner acknowledges that

the teachings of Chu and JP '431 present different solutions to the same conductivity problem, the Examiner asserts that the mere notation of an advantage or disadvantage for one solution over another is insufficient to show patentability for an invention that is otherwise obvious.

As a point of clarification, in order to establish a *prima facie* obviousness rejection, the Examiner needs to provide evidence of a motivation to combine the individual elements in order to create the recited invention. In establishing the motivation in light of the record as a whole, the Examiner needs to account for evidence of contrary, conflicting, and alternate teachings in order to set forth the extent to which one of ordinary skill in the art would have been persuaded to follow or not follow the proposed combination. In re Young, 18 USPQ2d 1089 (Fed. Cir. 1991) cited by MPEP 2143.01.

The Examiner has not proffered such evidence that Chu would suggest looking to porosity in the current collector, and it is noted that Chu instead suggests incorporating the elemental sulfur into a composite active material and using additives to further increase conductivity. (Col. 5, lines 1-37 of Chu). Since there is no suggestion in Chu that the composite active material necessarily includes pores or that pores would be advisable, there is no evidence that the relevance of the pore sizes suggested in JP '431 would not be understood by one of ordinary skill in the art. As such, there remains insufficient evidence of a motivation to generate or alter pore sizes using the cloth of JP '431.

Moreover, since JP '431 teaches using melted sulfur in order to allow the sulfur to infuse a graphite felt or cloth having the porosity disclosed in JP '431, the type of slurry suggested in Chu would not be understood as being capable of infusing the pores suggested in JP '431. As such, based upon the combined suggestions and disclosures of JP '431 and Chu, there is insufficient evidence that the advantages suggested in JP '431 in the context of melted sulfur, which is able to infuse the pores of porous graphite felt or cloth, would be achieved by the thick slurry of the composite active material disclosed in Chu.

As noted in MPEP 2143.01, "[I]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)." Thus, references cannot be combined where the proposed combination would so change a basic mode of operation of the primary reference that the combination would not be workable. Since the use of the positive active material of Chu would appear to change a mode of operation of the cloth in JP '431 since the positive active material would not infuse the pores, it is respectfully submitted that there is insufficient evidence to maintain a *prima facie* obviousness rejection of claims 1-4, 8-17, 38, and

39 under 35 U.S.C. §103 in view of the Chu and JP '431.

To the extent that the combination is otherwise proper, the Examiner asserts on page 9 that the broad range of pores sizes disclosed in JP '431 overlaps the recited range of claims 1-3. As a point of clarification, the pores sizes disclosed in JP '431 are between 10 μm and 1000 μm , which therefore does not overlap the ranges set forth in claims 2 and 3. Further, to the extent the broad range disclosed in JP '431 overlaps the range recited in claim 1, where evidence exists of record that a recited range imparts a novel feature as compared to the general conditions suggested in the existing art, the rejection cannot be maintained. Specifically and as noted in MPEP 2144.05(III), "[t]he law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.' *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990)."

Additionally, in making a rejection based on the obviousness of a claimed feature, the Examiner needs to account for evidence in embodiments and experiments set forth in the specification that show the non-obvious nature of the feature. *In Re Glaug*, 62 USPQ2d 1151 (Fed. Cir. 2002). As noted in MPEP 2144.08, "a showing of unexpected results for a single member of a claimed subgenus, or a narrow portion of a claimed range would be sufficient to rebut a *prima facie* case of obviousness if a skilled artisan 'could ascertain a trend in the exemplified data that would allow him to reasonably extend the probative value thereof.' *In re Clemens*, 622 F.2d 1029, 1036, 206 USPQ 289, 296 (CCPA 1980) (Evidence of the unobviousness of a broad range can be proven by a narrower range when one skilled in the art could ascertain a trend that would allow him to reasonably extend the probative value thereof.)"

As noted in the Amendment filed on April 6, 2005, the examples set forth in the specification, Tables, and FIGs. demonstrate a difference in performance relevant to pore sizes of between 15 μm and 5 μm pore diameters. It is respectfully submitted that the combined examples demonstrate a trend not disclosed, suggested in, or expected from JP '431. Specifically, JP '431 suggests pores between 10-1000 μm , and does not suggest which portion of this range would achieve the best conductivity. As such, there is no expectation as to which element of this large range would achieve the best conductivity, nor an invitation to explore pore diameters below 10 μm or above 1000 μm . In contrast, as shown in the examples in the specification, as the pore diameter decreases, performance improves in regard to at least long term capacity retention and discharge current density retention and dramatically improves the performance over pore diameters in excess of 30 μm . It is respectfully submitted that this

unexpected trend demonstrates the non-obvious nature of the claimed invention as compared to the combination, which neither disclosed nor suggests such an outcome.

Since the Examiner has not addressed this evidence of non-obviousness contained in the specification as compared to any expected results, it is respectfully requested that the Examiner reconsider and withdraw the rejection of claim 1.

Similarly, while the Examiner asserts on pages 9-10 that ranges below 10 μm are "close enough" to suggest obviousness, there remains no disclosure or suggestion as to why one of ordinary skill in the art would explore such an additional range as compared to ranges in excess of 1000 μm . In essence, no such expectation of improved results was set forth in JP '431 for pore diameters less than 10 μm , and no suggestion that such a benefit exists so as to a specific subrange at the extreme low end of the 10 μm or above 1000 μm is disclosed in JP '431. Further, it is respectfully submitted that, as shown in Table 1, there is a benefit shown in ranges below 10 μm and at or above 5 μm that is not suggested in or expected from JP '431. It is therefore respectfully submitted that there is no evidence of a suggestion to reach beyond one specific portion of the disclosed range in JP '431. As such, it is respectfully requested that the Examiner reconsider and withdraw the rejection of claims 2 and 3.

Lastly, it is noted Chu also teaches a solution to overcome the insulative problem of sulfur as set forth in col. 2, lines 5-26 and col. 9, lines 45-60 of Chu. As such, Chu already suggests a solution to the very problem which JP '431 purports to solve. Additionally, Chu further resolves problems in regard to lithium depletion as set forth in col. 9, lines 5-60 which is not suggested as being resolved in JP '431 such that the solution of Chu would be seen by one of ordinary skill in the art as being a superior solution as compared to the solution suggested by the Abstract in JP '431. There is further no suggestion in Chu that pores should be used, and there is no suggestion in JP '431 that the specific porosity presents a more advantageous solution than the solutions set forth in Chu. As such, beyond showing that pores of a specific size existed in the prior art, since JP '431 does not disclose a particular advantage to their use over the advantages set forth in Chu, there remains no suggestion to include the specific feature in JP '431 in Chu. It is this reason for the substitution of elements which is required in order to prevent the trap of impermissible hindsight.

As interpreted by MPEP 2143.01, In re Fine 5 USPQ2d 1596 (Fed. Cir. 1988) is a case where an Examiner applied two references to create the recited invention. Both the Examiner and the Board of Appeals agreed that it would have been within the skill of the art to make the asserted combination by substituting one detector for another detector. The Federal Circuit reversed on the grounds that the possibility that a combination can be made does not provide

sufficient evidence as to why one of ordinary skill in the art, based on the teachings in the references, would be motivated to combine the references. Specific emphasis was made by the Federal Circuit that the suggestion needs to come from the prior art. In re Fine, 5 USPQ2d at 1599-1600.

In the context of conflicting methodologies of accomplishing a common goal, where one methodology is more advantageous in accomplishing this same goal than the other methodology, there should be evidence which would guide one of ordinary skill in the art to adopt the less advantageous methodology. Otherwise, the record does not support the rationale for choosing one solution of the other and does not reflect the motivations of one of ordinary skill in the art. For instance, in Ruiz v. A.B. Chance Co., 69 USPQ2d 1686 (Fed. Cir. 2004), which is discussed in MPEP 2143.01, the Federal Circuit held that the nature of the problem to be solved can provide evidence of obviousness. However, the Federal Circuit specifically noted that multiple items of evidence existed in the record which circumstantially supported the combination and also noted that the District Court performed "a detailed and reasoned analysis of the evidence, rather than a conclusion-oriented discussion that typically accompanies a hindsight analysis" such that the lack of an explicit written instruction to make a combination to achieve a common goal was not needed. As such, there remains a need to evaluate the evidence of record and to provide evidence from the suggestions of record as to why one of ordinary skill in the art would make an asserted combination. It is respectfully submitted that there remains insufficient evidence of record to maintain a prima facie obviousness rejection of the claims and it is requested that the Examiner reconsider and withdraw the rejection.

B. Rejection of claims 5-7 in view of Chu, JP '431, and Kovalev et al.

In the Office Action at pages 10-11, the Examiner rejects claims 5-7 under 35 U.S.C. §103 in view of Chu, JP '431, and Kovalev et al. (U.S. Patent No. 6,652,440). The rejection is respectfully traversed and reconsideration is requested.

The Examiner relies upon Kovalev et al. as disclosing a particle size of elemental sulfur in the range of 0.01 to 100 microns, but not as otherwise curing the above noted defect of the combinations of Chu et al. and JP '431 as applied to claim 4, from which claims 5-7, depend. As such, it is respectfully submitted that the combination does not disclose the invention recited in claims 5-7 due at least to the combinations not disclosing the features of claim 4.

Additionally and as noted in the Amendment of April 6, 2005, Kovalev et al. suggests multiple particle sizes for elemental sulfur, including particles from .01 to 100 microns, but Kovalev et al. does not suggest which particle size should be used within this broad range, or which portion of the range is advantageous to use. Importantly, Kovalev et al. does not suggest

why the disclosed elemental sulfur is advantageous over other elemental sulfurs, such as that disclosed in Chu et al.

On page 13 of the Office Action, the Examiner asserts that the disclosed range in Kovalev et al. overlaps the range recited in claims 5-7 such that the Examiner has met a prima facie obviousness burden. However, as similarly noted above, the examples in the instant application set forth evidence of the advantages of specific ranges of particle sizes which are not suggested in Chu et al., JP '431, or in the broad range suggested in Kovalev et al. Further, while the Examiner asserts that applicants have admitted that there is no unexpected property for particle sizes of 15 μm , applicants have made no such admission. Moreover, as noted in Table 1, for particle sizes of 15 μm , the capacity of the cells remains at least 55% after 50 cycles, whereas the capacity drops dramatically to 30% for sizes of 30 μm such that the trend shows an improvement in capacity not suggested in the prior art. Therefore, consistent with MPEP 2144.08, it is respectfully submitted that there is evidence of record suggesting the nonobvious and unexpected nature of the invention for which the Examiner needs to account in maintaining the obviousness rejection of claims 5-7.

CONCLUSION:

In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot. And further, that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited. At a minimum, this Amendment should be entered at least for purposes of Appeal as it either clarifies and/or narrows the issues for consideration by the Board.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited and possibly concluded by the Examiner contacting the undersigned attorney for a telephone interview to discuss any such remaining issues.

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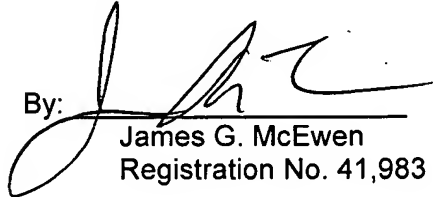
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If there are any additional fees associated with the filing of this Response, please charge the same to our Deposit Account No. 503333.

Respectfully submitted,

STEIN, MCEWEN & BUI LLP

By:

A handwritten signature in black ink, appearing to read 'J. McEwen', is written over a horizontal line.

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